

RESPONSE TO OFFICE ACTION  
"Method And Apparatus For The Treatment Of Individual Filaments Of A Multifilament Yarn"  
Serial No. 10/731,863  
Atty. Docket No. SSCM-030716.002  
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## AMENDMENTS TO THE CLAIMS

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1.-21. (Canceled)

22. (Withdrawn) An apparatus for the treatment of individual filaments of a multifilament

5 yarn, the apparatus comprising:

a treatment solution reservoir, containing a predetermined amount of liquid treatment solution, having at least one sidewall and a bottom; and

a yarn transfer system configured to feed at least one yarn through the reservoir, having at least one filament orientation disruption assembly configured to guide the yarn through a portion of the reservoir and disrupt the orientation of the individual filaments thereby exposing previously unexposed surface areas of each individual filament to the treatment solution.

23. (Withdrawn) The apparatus of Claim 22, wherein the at least one sidewall includes an entry sidewall, formed with an entry weir, an exit sidewall, formed with an exit weir, and

15 wherein the treatment solution is maintained at a solution level above that of the entry weir and the exit weir such that the treatment solution flows from the reservoir through the entry weir and the exit weir, and the entry weir and exit weir are configured such that the yarn repeatedly enters and exits the reservoir through the entry weir and exit weir.

20 24. (Withdrawn) The apparatus of Claim 22, wherein the bottom is formed with at least one yarn slot configured so that the treatment solution flows from the reservoir through the at least

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one yarn slot and the yarn repeatedly enters and exits the reservoir through the at least one yarn slot.

25. (Withdrawn) The apparatus of Claim 23, wherein at least one filament orientation  
5 disruption assembly includes a first filament orientation disruption assembly and a second  
filament orientation disruption assembly, wherein the first filament orientation disruption  
assembly includes a first roller, located external to the reservoir and in close proximity to the  
entry weir, and the second filament orientation disruption assembly includes a second roller,  
located external to the reservoir and in close proximity to the exit weir, wherein the first roller  
10 and the second roller are configured to rotate as the yarn turns about the first roller and the  
second roller, and configured to guide the yarn through the entry weir, the reservoir, and the exit  
weir while disrupting the orientation of the individual filaments thereby exposing previously  
unexposed surface areas of each individual filament to the treatment solution.

15 26. (Withdrawn) The apparatus of Claim 23, further including a collection and filtration  
system having a collection basin, configured to collect the treatment solution as it exits the entry  
weir and the exit weir, a filtration assembly to filter the treatment solution collected in the  
collection basin, and a pump to transfer the filtered treatment solution back into the treatment  
solution reservoir.

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27. (Withdrawn) The apparatus of Claim 22, further including an ultrasonic agitation system,  
in operative communication with the treatment solution reservoir, to agitate the yarn and the

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treatment solution further increasing the orientation disruption of the individual filaments and increasing the exposure of substantially all of the surface area of each individual filament to the treatment solution.

5 28. (Withdrawn) The apparatus of Claim 22, wherein the yarn is fed through the apparatus under a predetermined amount of tension.

29. (Withdrawn) The apparatus of Claim 23, wherein the treatment solution reservoir is configured to facilitate a bottom-to-top and center-to-sides flow pattern to reduce contamination  
10 of the treatment solution.

30. (Withdrawn) An apparatus for the treatment of individual filaments of a multifilament yarn, the apparatus comprising:

15 a treatment solution reservoir, containing a predetermined amount of liquid treatment solution, having an entry sidewall formed with an entry weir, an exit sidewall formed with an exit weir, and wherein the treatment solution is maintained at a solution level above that of the entry weir and the exit weir such that the treatment solution flows from the reservoir through the entry weir and the exit weir, and the entry weir and exit weir are configured such that the yarn may repeatedly enter and exit the reservoir through the entry weir and exit weir;

20 a yarn transfer system having a first filament orientation disruption assembly and a second filament orientation disruption assembly, wherein the first filament orientation disruption assembly includes a first roller having a plurality of yarn fingers and the second filament

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orientation disruption assembly includes a second roller having a plurality of yarn fingers, the first roller and the second roller configured to rotate as the yarn turns about the first roller and the second roller, and configured to guide the yarn through the entry weir, the reservoir, and the exit weir while disrupting the orientation of the individual filaments thereby exposing substantially  
5 all of the surface area of each individual filament to the treatment solution prior to final exit from the apparatus; and

a collection and filtration system having a collection basin, configured to collect the treatment solution as it exits the entry weir and the exit weir, a filtration assembly to filter the treatment solution collected in the collection basin, and a pump to transfer the filtered treatment  
10 solution back into the treatment solution reservoir.

31. (Withdrawn) The apparatus of Claim 30, further including an ultrasonic agitation system, in operative communication with the treatment solution reservoir, to agitate the yarn and the treatment solution further increasing the orientation disruption of the individual filaments and  
15 increasing the exposure of substantially all of the surface area of each individual filament to the treatment solution.

32. (Withdrawn) The apparatus of Claim 30, wherein the yarn is fed through the apparatus under a predetermined amount of tension.

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33. (Withdrawn) The apparatus of Claim 30, wherein the treatment solution reservoir is configured to facilitate a bottom-to-top and center-to-sides flow pattern to reduce contamination of the treatment solution.

5 34. (New) A continuous method for plating of individual filaments of a multifilament yarn, the method comprising:

(a) providing a plurality of processing cells, wherein each processing cell has a treatment solution reservoir containing a predetermined amount of a treatment solution;

10 (b) feeding the yarn into a first yarn transfer system that guides the ingress and egress of the yarn from an acidic solution and simultaneously disrupts the orientation, and achieves a pre-determined amount of tension and agitation of the individual filament of the yarn with a roller having a roller profile variation chosen from the group of roller profiles consisting of a surface varied roller and a contour varied roller to achieve a substantially uniform etching of the exterior surface of each individual filament;

15 (c) transferring the yarn from the first yarn transfer system to a second yarn transfer system that guides the orientation of the individual filament from an ultrasonic water bath and simultaneously disrupts the orientation and achieves a pre-determined amount of tension and agitation of the individual filament of the yarn with a roller having a roller profile variation chosen from the group of roller profiles consisting of a surface varied roller and a contour varied  
20 roller to achieve a substantially clean and wet exterior surface of each individual filament;

(d) transferring the yarn from the second yarn transfer system to a third yarn transfer system that guides the orientation of the individual filament from a catalyzing solution and

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simultaneously disrupts the orientation and achieves a pre-determined amount of tension and agitation of the individual filament of the yarn with a roller having a roller profile variation chosen from the group of roller profiles consisting of a surface varied roller and a contour varied roller to achieve a substantially uniform infiltration of a plurality of metal ions on each  
5 individual filament;

(e) transferring the yarn from the third yarn transfer system to a fourth yarn transfer system that guides the orientation of the individual filament from a reduction solution and simultaneously disrupts the orientation and achieves a pre-determined amount of tension and agitation of the individual filament of the yarn with a roller having a roller profile variation  
10 chosen from the group of roller profiles consisting of a surface varied roller and a contour varied roller to achieve a substantially uniform in-situ reduction of a plurality of metal ions on each individual filament of the yarn; and

(f) transferring the yarn from the fourth yarn transfer system to a fifth yarn transfer system that guides the orientation of the individual filament from a electroless bath and  
15 simultaneously disrupts the orientation and achieves a pre-determined amount of tension and agitation of the individual filament of the yarn with a roller having a roller profile variation chosen from the group of roller profiles consisting of a surface varied roller and a contour varied roller to achieve a substantially uniform conductive undercoating on each of the individual filaments of the yarn.

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35. (New) The method according to Claim 34, wherein the surface varied roller further comprises a roller having alternating non-gripping and gripping sections.

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36. (New) The method according to Claim 34, wherein the contour varied roller further comprises a roller having at least one roller glove.

5 37. (New) The method according to Claim 34, wherein contour varied roller further comprises a roller having at a plurality of yarn fingers.

38. (New) The method of Claim 34, wherein the treatment solution does not contain a surfactant.

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39. (New) The method of Claim 34, further including the step of agitating the yarn and the treatment solution with an ultrasonic agitation system, in operative communication with the treatment solution reservoir, further increasing the orientation disruption of the individual filaments and the amount of coated surface area.

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40. (New) The method of Claim 34, wherein the treatment solution is an acidic solution and the method substantially uniformly etches each individual filament of the yarn.

41. (New) The method of Claim 34, wherein the treatment solution is a palladium salt  
20 solution and the method facilitates substantially uniform absorption of a plurality of palladium ions on each of the individual filaments of the yarn.

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42. (New) The method of Claim 34, wherein the treatment solution is an alkaline sodium borohydride solution and the method substantially uniformly reduces a plurality of previously deposited palladium ions to form a substantially uniform coating of palladium metal on each of  
5 the individual filaments of the yarn.

43. (New) The method of Claim 34, wherein the acidic solution, the bathing solution, the catalyzing solution, and the reduction solution are free of surfactants.

10 44. (New) The method of Claim 34, wherein the multifilament yarn is composed of a plurality of polymeric filaments.

45. (New) The method of Claim 44, wherein the plurality of polymeric filaments is selected from the group consisting of polyacrylonitrile, aromatic-heterocyclic rigid-rod and ladder  
15 polymers.

46. (New) The method of Claim 45, wherein the aromatic heterocyclic rigid-rod further comprises poly(*p*-phenylene benzobisoxazole) (PBO).

20 47. (New) The method of Claim 45, wherein the aromatic heterocyclic rigid-rod further comprises poly{2,6-diimidazo[4,5-*b*:4'5'-*e*]pyridinylene-1,4(2,5-dihydroxy)phenylene} (M5).



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48. (New) The method of Claim 34, wherein the yarn is fed from the first yarn transfer system to the fifth yarn transfer system under varying amounts of predetermined tension.

49. (New) The method of Claim 34, wherein the catalyzing solution is a palladium salt solution.

50. (New) The method of Claim 34, wherein the reduction solution is an alkaline sodium borohydride solution.

51. (New) The method of Claim 34, wherein the method further comprising at least one step of electroplating the multifilament yarn.

52. (New) A method for the treatment of individual filaments of a multifilament yarn, the apparatus comprising:

passing the multifilament yarn through at least one treatment solution reservoir, containing a predetermined amount of liquid treatment solution, having at least one sidewall and a bottom; and

simultaneously passing the multifilament yarn across a yarn transfer system further comprising at least one roller having a roller profile variation chosen from the group of roller profiles consisting of a surface varied roller and a contour varied roller configured to feed at least one yarn through the reservoir, and;

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the roller thereby disrupting the orientation of the individual filaments exposing previously unexposed surface areas of each individual filament to the treatment solution.

53. (New) The method of Claim 52, wherein the step of removing at least a portion of the treatment solution from the treatment reservoir further comprises the step of facilitating a bottom-to-top and center-to-sides flow pattern of the treatment solution in the treatment reservoir.
54. (New) The method of Claim 52, wherein the step of passing the multifilament yarn through at least one treatment solution reservoir further comprises the step of passing the yarn into the treatment through at least one yarn slot, wherein the yarn slot allows continuous egress of treatment solution from the treatment reservoir.